

Putting Innovative Building Technologies to the Test

GSA's Green Proving Ground Program

Kevin Powell, GPG Program Director, 11.05.14



The Innovation Lever

GPG Overview



GPG leverages GSA's real estate portfolio to evaluate innovative technologies in order to accelerate GSA's sustainability goals, reduce operational costs and lead market transformation.



Established in October, 2010

Agenda

- What is the GPG Program
- What are program outcomes?
- Where to go for more information



Owned and Leased Assets
9,011

378 million

RSF across the US

\$376 million/yr

Energy costs

41%

More efficient than typical commercial
building

GSA Targets

30%

Reduction in Energy Use Intensity, by 2015

26%

Reduction in Water Use Intensity, by 2020

28%

Reduction in Scope 1 and 2 GHGs, by 2020

Net Zero

All capital project designs starting 2020
Achieve net zero by 2030



Executive Order 13514, 2009

Energy Independence and Security Act, 2007

MOU on High Performance and Sustainable Buildings, 2006

Energy Policy Act, 2005

www.wbdg.org/references/federal_mandates.php

Opportunities and Drivers

GSA Portfolio

- Large urban buildings with central plant
 - 90% buildings over 100,000 square feet
 - 80% portfolio energy spend: buildings > 200k square feet
- Majority in mild climate zone
 - More than 80% in ASHRAE climate zones 3, 4, 5
- Energy efficient
 - Majority Energy Star 80 or better
- “Smart Buildings” infrastructure
 - Smart meters and national BMS for 200 most energy intensive facilities
 - Big data: GSA Link logs 15 million data points / day



Green Proving Ground

Program Objectives

Innovative building technologies are evaluated in the real world operating environment of GSA's real estate portfolio. Successful technologies:

- Increase environmental performance
- Decrease operational costs
- Improve tenant satisfaction
- Have potential to transform markets through limited or broad deployment



Green Proving Ground

Technology Selection

6 months



1. Applications vetted by National Laboratories (106 applications submitted in FY2014)
2. 20-30 shortlisted
3. 5-10 with the greatest deployment potential for GSA selected for M&V



Green Proving Ground Technology Assessment

- 18 months
↓
1. Test-bed site selection
 2. Project plan
 3. Test-bed installation
 4. Test-bed evaluation
 5. Report publication with deployment recommendation

What are We Looking for?

Tools & Techs for Efficient Buildings

Assessment & Design Tools—Exploit “big data” to provide design & operational guidance (e.g. auditing & benchmarking tools, meters & sensors)

Lighting, HVAC, Building Envelope, Water—Efficient components that reduce energy consumption (e.g. LED lighting, condensing boilers, low-e window film)

Energy Management—Integrated system-level technologies that optimize operations and reduce energy consumption (e.g. socially driven HVAC, central plant optimization)

Power Generation & Distribution—Technologies that generate on-site power or manage energy markets (e.g. PV, microgrid control systems)

What are We Looking for?

Pre- to Early-Commercial Technologies



HIGHER ← RISKS/BENEFITS → LOWER

What Do We Recommend?

Deployment Guidelines

Climate/Location—e.g. cooling-dominated climates, dry climates, cold northern climates within 50 miles of a biomass pellet mill, facilities with intermittent rain

Energy Costs/Usage—e.g. lighting power density greater than 1.1 W/ft², buildings with long operating hours, hot-water heated facilities using fuel oil

Building/Space Type—e.g. data centers, land ports of entry, open plan office space

Existing Technology—e.g. single-pane windows, conventional boilers, rotary screw chillers, variable-frequency drive

What Do We Recommend?

Under What Conditions?

Replace at End of Life

Next time this equipment needs to be replaced, invest in this technology instead

Retrofit

Introduce technologies that immediately improve performance

New Construction

Choose the best in class performance and payback, from the beginning

GPG Technology Evaluations Completed



BUILDING ENVELOPE

- Vacuum Insulated Panels, 03.14
- Chromogenic Windows, 03.14
- High R Value Windows, 12.13

ENERGY MANAGEMENT

- Plug Load Control, 09.12
- Wireless Sensor Networks, 03.12

LIGHTING

- Integrated Daylighting Systems, 07.14
- Occupant Responsive Lighting, 09.12

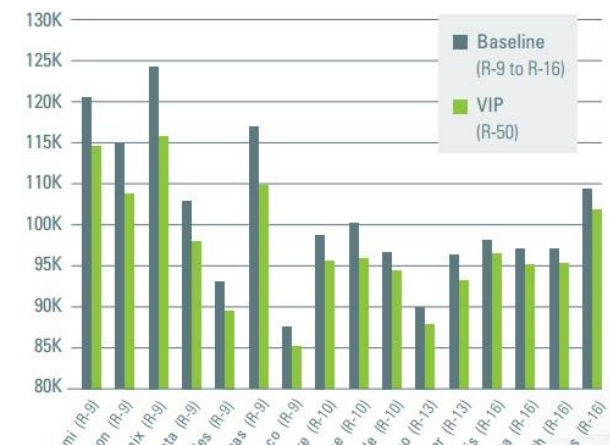
HVAC

- Wood-Pellet-Fired Biomass Boiler, 06.14
- Indirect Evaporative Cooler, 03.14
- Synchronous & Cogged Fan Belts, 03.14
- Variable Speed MagLev Chiller, 12.13
- Variable Refrigerant Flow, 12.13
- Condensing Boilers, 12.12

ON-SITE ENERGY CONSUMPTION

- PV Guidance, 12.13
- Photovoltaics, 12.12

GPG Technology Evaluations Ongoing



BUILDING ENVELOPE

- EC Windows with Dynamic Controls
- Glazing Retrofit Coating
- Low-E Window Film

ENERGY MANAGEMENT

- Central Plant Optimization Strategies
- Passive Thermal Storage Platform
- Predictive HVAC Optimization
- Socially Driven HVAC
- Virtual Energy Audit

WATER

- Non-Chemical Water Treatment
- Wireless Moisture Sensing Irrigation
- BAS Integrated Weather Station Irrigation

HVAC

- High efficiency RTU
- Modular Absorption Chiller
- Variable Speed Screw Chiller
- Wireless Pneumatic Thermostat

LIGHTING

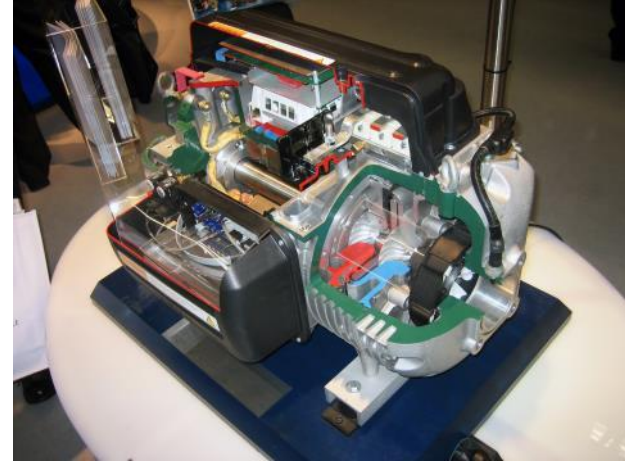
- LED Fixtures with Integrated Controls
- LED Replacement Lamps
- Networked Lighting
- Wireless Lighting Control System

ON-SITE ENERGY GENERATION & STORAGE

- Honeycomb Solar Thermal Collector
- PV with Solar Water Heating

Green Proving Ground

Successful Deployments



- Wireless Network Sensors—Deployed at 2 GSA-operated data centers, 1 tenant-operated in progress; on GSA Schedule.
- Maglev Chillers—39 sites installed, 21 pending; majority ESCO financed.
- Advanced Power Strips—over 16,000 units deployed at 80 federal facilities across the country; on GSA Schedule.
- Condensing Boilers—62 sites installed, 9 pending ; majority ESCO financed.

Green Proving Ground

Facilitating Deployment

- Advocacy—encourage relevant decision makers in government to adopt technologies that prove out
- GSA Schedule—favorable findings can help you sell directly to government agencies
- Third-Party Financing—proven technologies pose lower investor risk
- P100—proven technologies influence GSA's performance-based standards
- DOE Commercial Building Integration—high-impact technologies are identified for commercial building partners

Questions?

gsa.gov/gpg

Review the RFI at FedBizOpps: <http://goo.gl/3czILT>

Green Proving Ground Program

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Backup Slides

Green Proving Ground Program
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Energy Management : Early Comm'l

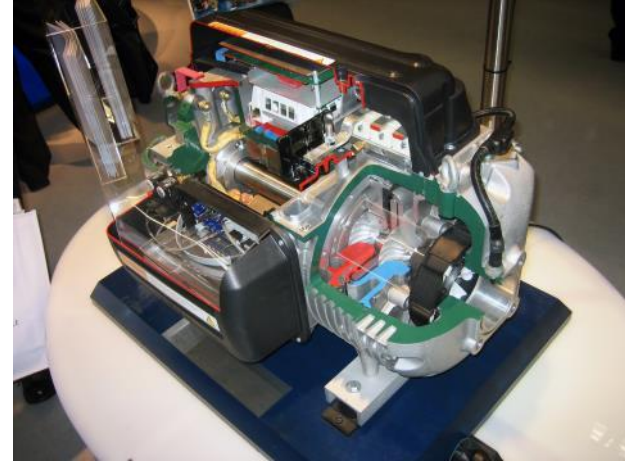
Wireless Network Sensors



- Dense network of wireless sensors provides real-time information enabling facility operator to better manage HVAC.
- 48% reduction in facility cooling load
- 3.4 years simple payback (@ \$0.045 kWh < 50% of national average \$0.11 kWh)
- Deploying at two GSA-operated data centers; 1 tenant-operated in progress
- On GSA Schedule

HVAC : Emerging Tech

Maglev Chillers



- Eliminate heat, noise and vibration with magnetic levitation and improve efficiency with variable speed drive
- Quiet performance allows chillers to be placed closer to occupant spaces
- 42% energy savings, < 5 year payback
- Deploy as end-of-life replacement for rotary screw chillers
- 39 sites installed, 21 pending

Energy Management : Emerging Tech

Advanced Power Strips



- Schedule-based control, where users determine the day and time when a circuit is energized, found to be most effective.
- 26% energy reduction at workstations with advanced computer management already in place, 50% energy reduction in kitchens and printer rooms
- Over 16,000 units deployed at 80 federal facilities across the country
- On GSA Schedule

HVAC : Underutilized Condensing Boilers



- Capture heat that is lost through steam in conventional boilers
- Energy savings at 6 locations averaged 22%
- Life-cycle cost-effective when only 3%-5% more efficient than high-efficiency boiler
- Key to savings is return-water temperature below 130 degrees
- Deploy as end-of-life replacement for conventional boilers where return water temperature < 130 is possible
- 62 sites installed, 9 pending